Abstract: Physical, chemical and a biological measurements were carried out and drinking water samples were collected from four areas Abu ghraib, Dora, Ghazaliya and Saydiya for period extended from February 2016 to September 2016, through the residential sites at different areas situated with various distances from the supplying source, three samples were taken monthly. Water temperature at sampling time was varied from 17.4°C to 30.8°C, for temperature at sampling time also. The results of pH values were within the allowable limits, ranging from 6.5 in winter to 8.2 in summer. The highest value of turbidity recorded for drinking water was in spring with 21 NTU and the lowest value was in summer with 0 NTU. The study showed that the results of TDS values ware ranged from 520 mg/L in winter to 200mg/L in spring. The highest value of residual chlorine was recorded in winter with 2.01 mg/L; the lowest value was 0.1 mg/L in spring. The current results showed an increased in the number of autotrophic bacteria, total coliform, and E. coli during winter season in most study locations as compared to those of the other seasons for drinking water. The Total plat count results of drinking water were exceed 100 cell/ml, the allowable limit for drinking water, for some samples in some sites. On the other hand, the TC, and E. coli exceeded zero cell/100ml, the allowable limits for drinking water, in some drinking water samples for some sites.

Keywords: Microbial quality, physicochemical properties, drinking water, Baghdad.
for physiochemical analysis using pre-washed polyethylene bottle by water sample twice before filling (7). Water sample for biological analysis was collected in closed glass bottles, contained 0.2 ml of a sodium thiosulfate solution concentration of 10% to offset the effect of residual chlorine sterilized by the autoclave at temperature of 121 °C for 30 minutes at 15 Par. then kept in cool box till carrying to a laboratory for examination (8).

Methods
Water sample for physic-chemical parameters include water temperature (by using thermometer), hydrogen ion concentration (by using pH-meter), turbidity level (by using turbidity-meter) and residual chlorine (by using addition methods) and TDS were measured according to APHA (7). Water sample for biological analysis (total coliform, fecal coliform and fecal streptococcus) used multiple fermentation tube or most probable number (MPN) technique are commonly used for enumeration of the bacteria (8), while total bacterial count (TBC) was carried out using the pour plate technique according to described by APHA (8).

Results and Discussion
Physical-chemical properties
The distribution and monthly variation of the physical-chemical qualities in the drinking water from four sites are shown in the Figure 1,2,3,4&5 ,respectively. water temperature is an important factor in any aquatic environments affecting on biological processes, The obtained results showed that the water temperature values were varied from highest value (30.8°C) in summer at site Saydiya and showed mean temperature values (30.53°C) to lowest value (17.4°C) in winter at sites Ghazaliya and showed mean temperature values (18°C). This result was similar to previous studies done by (Al-Helaly and Al-Mayah (9,10). In this study, the results of pH for drinking water samples from different sites showed that the highest value (8.2) during summer at Dora site, and showed that the mean of pH values was (7.96) and the lowest pH water content (6.5) was found in winter at Dora site showed mean of pH values reached to 6.53 this result agreed with (11), they reported that Iraqi inland water is regarded to be on the alkaline side of neutrality, reflecting geological formations of the area and the results are agree with the finding that recorded by Al-Lami and Al-Obaidi (12,13). In this study the maximum turbidity level for drinking water sample recorded in spring 21 NTU for Saydiya site, which its turbidity mean value recorded 20.67 NTU, whereas, the minimum level recorded in summer was zero NTU for all sites. Water turbidity is caused by increasing of rainfall proportion and rising water levels with all the drifting of these rains that are ended in river water as well as discharge water which leads to increase the level of organic materials and other materials that increase turbidity (14)(15).

For free residual chlorine of drinking water, the highest value showed 2.01 mg/l which was recorded in site of Saydiya in winter. Mean of free residual chlorine was 1.94 mg/l while the lowest value 0.10 mg/l was recorded in site of Ghazaliya in spring. Mean of free residual chlorine was 0.336 mg/l. Also the results showed high percentages of free residual chlorine in drinking water in March despite with high temperatures, which directly affect the concentration of chlorine causing its volatilization and the reason is that most of the water purification plants add largest doses of chlorine to the water in March than in December because of increased pollution due to low water levels in March (16, 17). The results were in agreement with results of Barakat and Al-Hashimi (18,19).Current results revealed that the maximum value was 520 mg/l of TDS of drinking water which was recorded in winter for Abu ghraib site, and TDS mean value 513.33 mg/l, and the minimum value reached to 200 mg/L that was recorded in spring for site of Abu ghraib, and TDS mean value was 210 mg/l.
Figure 2. Mean PH values of drinking water samples during study period

Figure 3: Mean TDS values of drinking water samples during study period from Feb-Sep 2016

Figure 4. Mean Turbidity values of drinking water samples during study period

Figure 5: Mean Residual Chlorine values of drinking water samples during study period from Feb-Sep 2016
Microbial properties

Figures (6,7,8,9&10) showed distribution and monthly variation for numbers of the bacteria species from four areas Abu ghraib, Dora, Ghazaliya and Saydiya. Regarding TPC, the current results have found examined drinking water samples from different sites, the highest TPC number was 240 CFU/ml and was recorded in water samples collected from site of Dora, during summer, while the lowest TPC number was zero CFU/ml and was detected in several examined sites in all seasons (Fig. 6).

Differences between these data were found to be significant at (P≤ 0.05) in terms of seasons for all sites and drinking water. The rise in TPC values may due to repeat fractures and defects afflicting distribution network pipeline, which increased the amount of exudes and leaked water from the surrounding environment of the pipe leading to the contamination especially in the case of scarcity and use pumps to draw water directly from the network and then increase the likelihood of pollution as a result of the low pressure and enter the sewage or contaminated groundwater. Increased turbidity level which works to reduce the rate of inhibition by disinfectants and providing protection and shelter for the bacteria and facilitate their passage through the distribution network, also lack of quality of filtration process because the filters are contaminated, the poor maintenance, and lack of regularity of washing filters. The pollution of water reservoirs was attributed to the presence of high levels of organic materials and particles deposited in the bottom of reservoirs that help the growth of bacteria in the largest (20). The values obtained are exceed the permissible limit for both Iraqi standard for drinking water (2001) and WHO standards drinking water (2004),(table, 1). This results are agree with the finding that recorded by (23,24).

Current results revealed that the maximum value and minimum values of FC of drinking water ranged from lowest value of 0 cell/100ml which recorded in all seasons, to the highest value of 16 cell/100ml which found in spring. (Fig.9). The drinking water examination showed high value also in spring with 16 cell/100ml for ghazaliya, and the lowest value recorded in all seasons zero cell/100ml.

From the study results it has been observed that high coliform numbers were found during the spring months and decreased numbers were detected in the hot summer months. This may be due to appropriate environmental conditions for the growth of these bacteria in the cold months has led to increasing numbers in the water, as the increase in rainfall and turbidity during the winter months which contributes to an increase in the number of coliform. The presence of coliform in drinking water may be attributed to inadequate chlorination, insufficient contact time, and poor maintenance of service reservoirs and may be because re growing of bacteria in the distribution system (22).

The values obtained are exceed the permissible limit for both Iraqi standard for drinking water (2001) and WHO standards drinking water (2004),(table, 1). Differences between these data were found significant (P≤ 0.05) in terms of drinking water sites and seasons. The absence of Fecal coliform in drinking water is an evidence of no fecal contamination and an indicator that water was clean within the distribution system (25).

The values of *E. coli* of drinking water ranged from lowest value of 0/100ml which recorded in all seasons, to the highest value of 16 cell/100ml which found in spring. (Fig.9). The drinking water examination showed high value also in spring with 16 cell/100ml for ghazaliya, and the lowest value recorded in all seasons zero cell/100ml.

In this study, the current results revealed that the maximum values and minimum values of FC of drinking water were recorded zero cell/100ml in all sites and seasons (Fig.10). The absence of bacteria in drinking water of the examined sites, evidence to the clean drinking water. These values obtained are exceed the permissible limit for both Iraqi standards for drinking water.
Table (1): Comparison between some water quality parameters of drinking water treatment plant with the Iraqi and international standards

| Parameter                     | WHO standards for drinking water in 2004 | Iraqi standard for drinking water | Present Study Minimum & Maximum
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.5 - 8.5</td>
<td>6.5 - 8.5</td>
<td>6.5 - 8.2</td>
</tr>
<tr>
<td>Turbidity NTU</td>
<td>0 - 50</td>
<td>0 - 5</td>
<td>0 - 21</td>
</tr>
<tr>
<td>Residual Chlorine mg/L</td>
<td>----</td>
<td>0.3 - 2.5</td>
<td>0.1 - 2.0</td>
</tr>
<tr>
<td>Heterotrophic CFU/100ml</td>
<td>100 cell / ml</td>
<td>10 cell / ml</td>
<td>0 - 240</td>
</tr>
<tr>
<td>Total Coliform CFU/1ml</td>
<td>Absent</td>
<td>Absent</td>
<td>33</td>
</tr>
<tr>
<td>Fecal Coliform CFU/1ml</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Fecal Streptococci CFU/1ml</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>E. coli CFU/1ml</td>
<td>Absent</td>
<td>Absent</td>
<td>0 - 16</td>
</tr>
</tbody>
</table>

References
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تقييم النوعية الميكروبية وبعض المؤشرات الفيزيوكيميائية لمياه الشرب في بعض الاحياء السكنية في مدينة بغداد – العراق

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الخلاصة

تم إجراء فحوصات فيزيوكيميائية وإحصائية لمياه الشرب في أربعة مناطق من بغداد الكرخ (الغالبية، غرب بغداد، والدورة، شيريا) لمدته من شباط 2016 إلى شير أيلول 2016، حيث ترعى مناطق من مصادر الفيض، ويعتبر الثلاثة نماذج من كل موقع، حيث تراوحت قيم درجة حرارة الماء وقت النمذجة من 0.1 °C إلى 8.3 °C، أما قيم العد اليدروجيني فقد كانت ضمن الحد المسموح به . ونماذج ما بين 2.6 بالملايين في الشتاء إلى 3.6 بالملايين في الصيف، و كانت أعمى قيمة لمكمور الحر المتبقي سجلت في الشتاء و كانت 6.10 مليمغم/لتر. وقد أظهرت الفحوصات كيميائية ارتفاع قيم كل من العد اليدروجيني، البكتريا القولونية الكميّة، الاشريشية القولونية، البكتريا الكيميّة الكميّة المطبقيّة ومكمور الحر المتبقي، حيث سجلت في عدد من مواقع الدراسة مقداراً بالعديد المليون من ملايين الملايين، ونماذج ما بين 0.1 مليمغم/لتر في الشتاء إلى 5.2 مليمغم/لتر في الشتاء، استناداً على قيمة القياس بفحص العينات لمهمة الدراسة. ونماذج ما بين 2.0 مليمغم/لتر في الشتاء إلى 9.2 مليمغم/لتر في الشتاء، استناداً على قيمة القياس بفحص العينات لمهمة الدراسة. ونماذج ما بين 2.0 مليمغم/لتر في الشتاء إلى 9.2 مليمغم/لتر في الشتاء، استناداً على قيمة القياس بفحص العينات لمهمة الدراسة.